

River Floodplain Modelling Using GIS Application: Purna

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ABSTRACT: This paper work shows the uplift of modeling by GIS softwares like Arc-GIS, HEC-RAS, HEC GeoRAS. This procedure is to be utilized to inundation area which is Purna river, Navsari district, Gujarat, India. To follow this methodology we need above mentioned three softwares, study area data, topography, hydraulic and hydrologic data, D.E.M. to make floodplain. We collected study area data from the CWC department to enter in HEC-RAS and D.E.M. data from ISRO Bhuvan website to proceed in Arc-GIS. Pre-processing done in Arc-GIS with D.E.M., shape file and mosaic process than after all data imported in HEC-RAS so we can make floodplain for choosed study area which can be use in critical situation to prepare for and respond to flood.

KEYWORDS: Softwares, D.E.M., Geo-Referencing, Study area data, Mosaic process, Shape file, HEC-RAS model.

I. INTRODUCTION

A flood is an overtop of water that submerges land. Causes of floods are high precipitation, Water from big river to small rivers in rainy season, increase in ocean level, Disaster like dam failure, drainage problem etc. As per the world disaster report most deaths caused by floods. Terrifying, shocking Isn't it? Flood affects the economy, environment, life. flood plain is a part of land adjacent to a stream with high level of soil which helps to control the water flow. This floodplain can be developed by using GIS technology. Community or group of people analysis study area data in software with proper methodology on P.C. to make geographical model that can be known as Geographical Information Technology (GIS).

This model can be executed in real life for solid waste management, mapping of flood zone, access nature of disaster like magnitude or scale, assessment of risk to damage. United States Army Corps of Engineers (USACE) use this technology to analysis river water. India has further scope in this field. It will be a great benefit to the people to implement a flood management program that consists of flood forecasting and flood hazard and vulnerability mapping.

II. OBJECTIVES

1. To download Digital elevation model of the study area.
2. To develop shapefile using ARC-GIS software.
3. To develop import file for the model execution in HEC-RAS software.
4. Evaluate the results simulation of flow in HEC-RAS for calculating flooding at different cross-sections.
5. To produce floodplain mapping of Purna river, Navsari district in ARC-GIS at peak discharge.

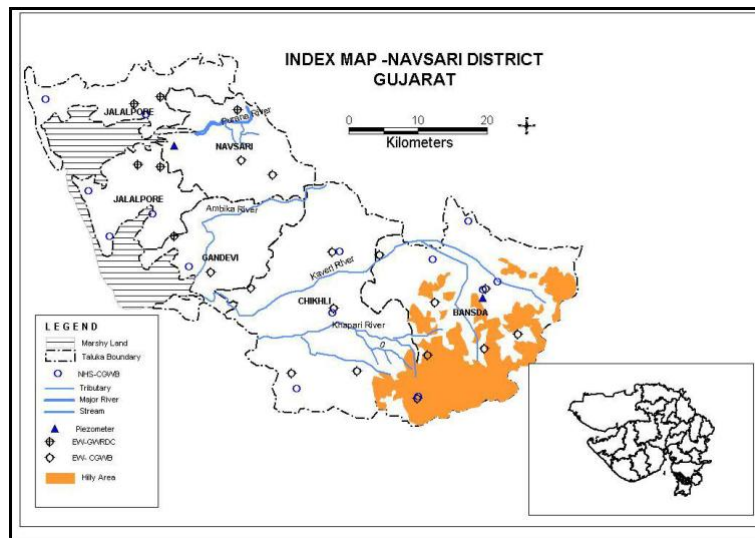
III. DATA COLLECTION AND ANALYSIS

A. Study Area

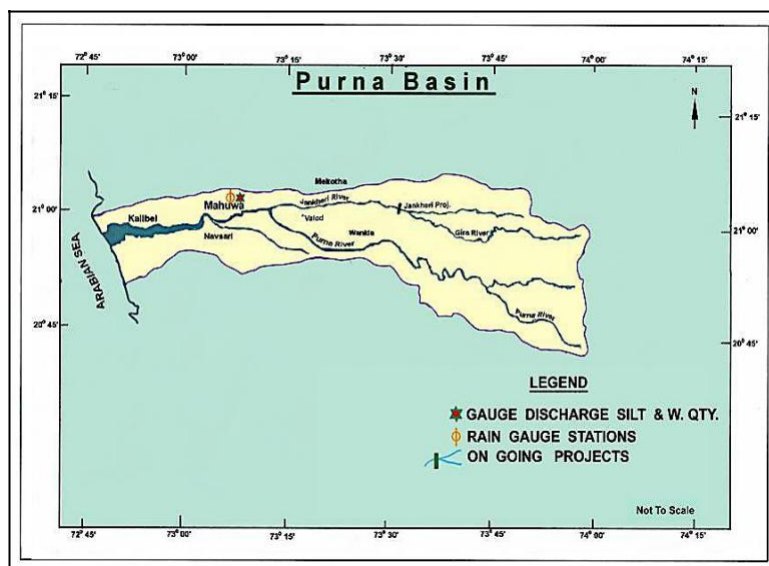
Navsari is located in Gujarat state of country India. It an urban and agricultural area which located at 20.95°N, 72.93°E. It has an average elevation of 9m above sea level near Purna river, within a few kilometres of the river's delta. The average annual rainfall is 122cm. In every rainy season rivers Ambika, Purna overflows which affects the river's delta so chance of flood getting higher with it.

B. Data collection

water level, discharge, digital elevation data etc. collected from Central Water Commission (C.W.C.) and State Water Data Centre (SWDC), Gandhinagar and Irrigation Department. Google resolution images downloaded from Google Earth. Annual minimum/maximum discharge with corresponding water level data collected from Water Year book from C.W.C. website for Purna Basin. ISRO BHUVAN website provides D.E.M. data openly free. Co-ordinates of study areas can be found out from the Google map in any browser. For Navsari district we have choose WGS 1984 UTM zone 43N path.



Index map of Navsari District, Surat (Source: <http://cgwb.gov.in/DistrictProfile/Gujarat/Navsari.pdf>)



Basin map of Purna river (Source: https://guj-nwrws.gujarat.gov.in/downloads/basin_description.pdf)

IV. METHODOLOGY AND PROCEDURE

A. Methodology

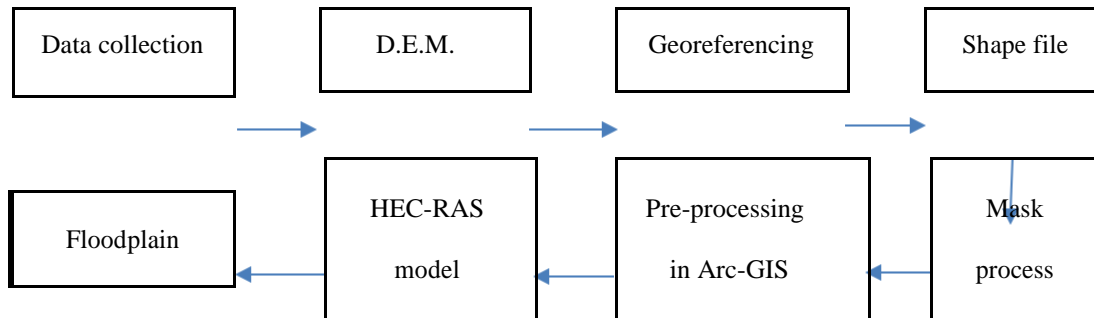


Fig 1. Flow chart of methodology

B. Procedure

1. D.E.M. Mosaic

Input D.E.M. data in Arc Map of choose study area Navsari district which was downloaded in separate parts from the ISRO BHUVAN website. Merge that data in one D.E.M. file is called as mosaic process.

2. Georeferencing

Navsari located at 20.95°N, 72.93°E co-ordinates which has to match with downloaded Navsari map image took from Google earth that process known as georeferencing.

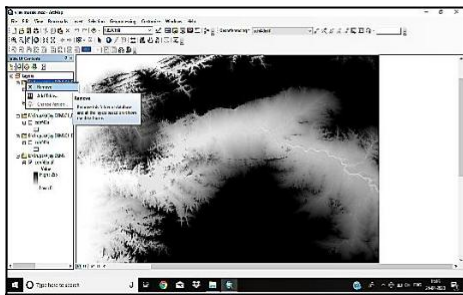


Fig 2. D.E.M. after mosaic process

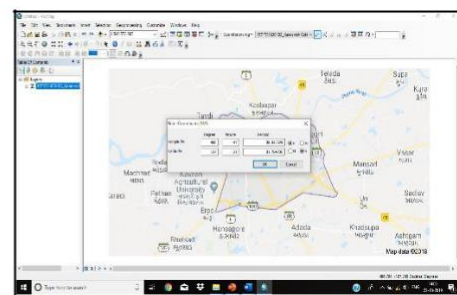


Fig 3. Geo-referencing with proper co-ordinates

3. Shapefile

It is non-topological format for storing the geometric location and attribute information of geographic features. Geographic features in a shapefile can be represented by points, lines, or polygons (areas).

4. Mask process

It is a feature use to extract D.E.M. data just for us choose shape file from merged mosaic file.



Fig 4. Creating shape file of Navsari

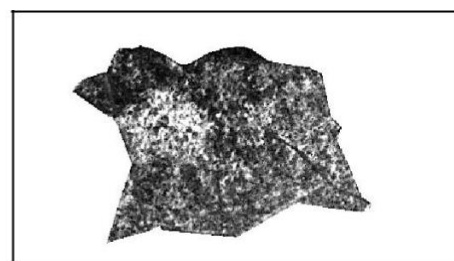


Fig 5. D.E.M. after mask process of Navsari

5. Pre-processing of data in Arc-GIS

In this we have to provide Stream centre lines, channel lines, cross section lines, length of river, stations, reach names, banks, flow direction etc. All geometry data which helps to analysis river stored here.

6. HEC-RAS model execution

All analysis, calculation will be done here. Also, we can compare models in HEC-RAS. All projects in water field can held in this software for model execution.

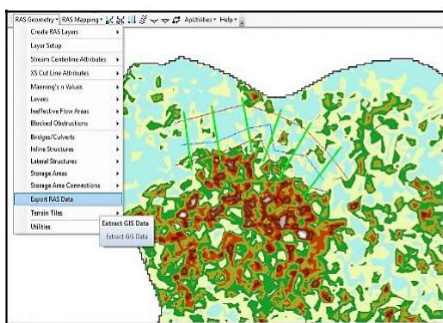


Fig 6. RAS layer in Arc Map

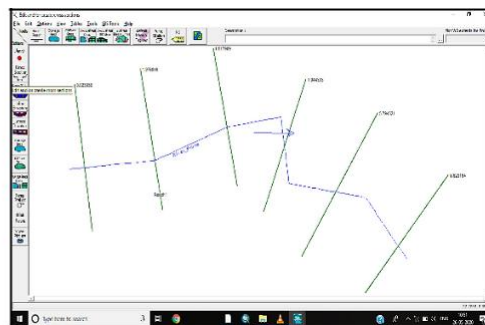


Fig 7. RAS model execution

7. Floodplain

From entering the elevation data at different provided stations with proper distance gives you floodplain in different perspective view or angle.

V. CONCLUSION

From the HEC-RAS model execution, we can get floodplain with choose cross section over mentioned river length. floodplain

shows the water surface profile at different cross section in different perspective view. Which can be used to avoid or minimizing

any kind of damage to people, environment, property.

We can use floodplain maps for: -

- Establishing zones, land-use and building standards.
- To support land use, infrastructure, transportation, flood warning, evacuation, and emergency planning.
- To prepare for and respond to flood.

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